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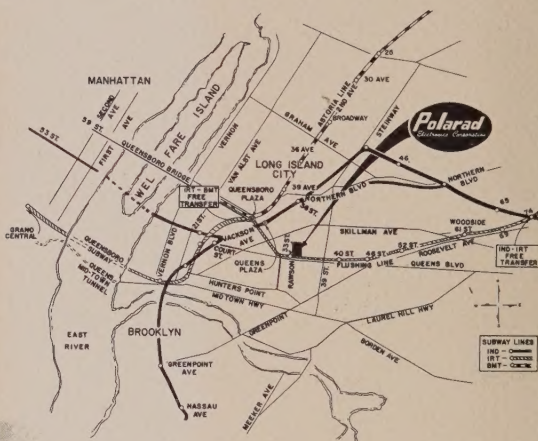
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**POLARAD ELECTRONICS
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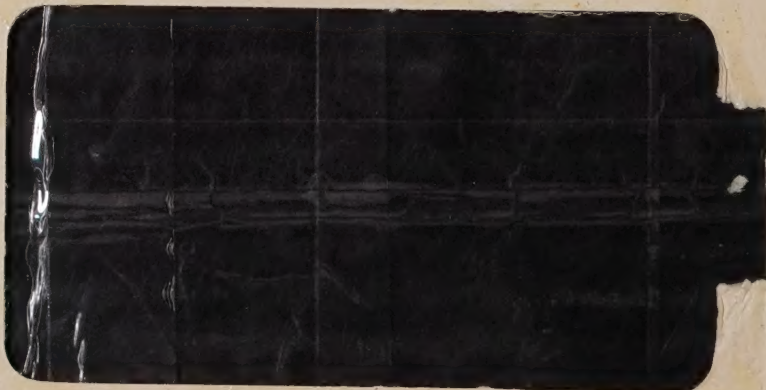
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CROSLEY DIVISION
ARMAMENT ENGINEERING
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INSTRUCTION MANUAL
MODEL SIJ
BROAD-BAND MICROWAVE ATTENUATOR

4 kmc - 12.4 kmc

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INSTRUCTION MANUAL

MODEL SIJ

BROAD-BAND MICROWAVE ATTENUATOR

4 kmc - 12.4 kmc

1. Purpose of the SIJ Attenuator

The Polarad Broad-Band Microwave Attenuator, Model SIJ, is intended for use as an external attenuator with any r-f signal source in the 4 kmc to 12.4 kmc range when one or more of the following conditions apply:

- a. Attenuator of the signal source output is desired.
- b. Attenuation of a signal source by a network is to be measured.
- c. Changes in the output level of a signal source load are to be measured.

It may be employed as a standard calibrated attenuator in microwave or power measurements. It may also be used for circuit protection (by coupling a small amount of energy from a high level source) or for r-f circuit isolation.

2. Specific Applications

Two representative applications of the SIJ Attenuator are briefly described below:

- a. Through its use a Polarad Microwave Signal Source or a laboratory oscillator may be converted into a signal generator. Attenuation of the output permits direct coupling to the load and reduces to a very low level r-f reflections due to variations in the load impedance. By means of the calibrated dial and calibration curves (Fig. 3, 4, and 5) the input to the load may be calibrated in db.

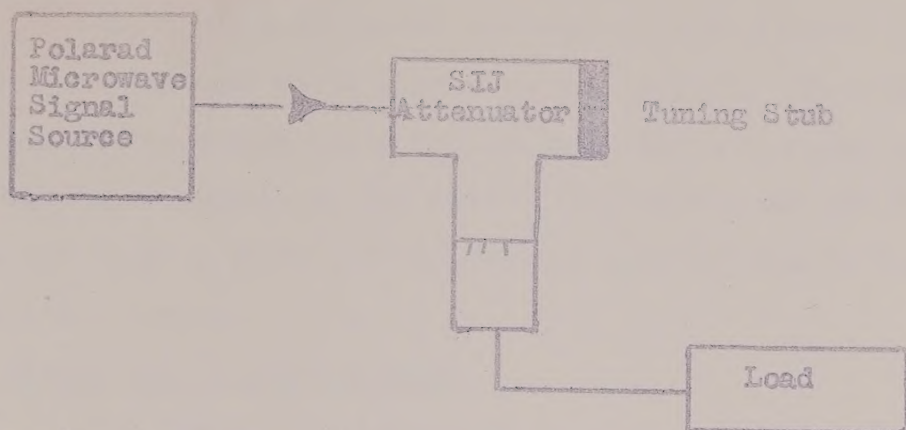


FIG. 1 - Signal Generator Set-Up Using Polarad Microwave Signal Source, and Model SIJ Attenuator

b. The attenuation of a network may be measured through the substitution method by means of the arrangement illustrated diagrammatically below:

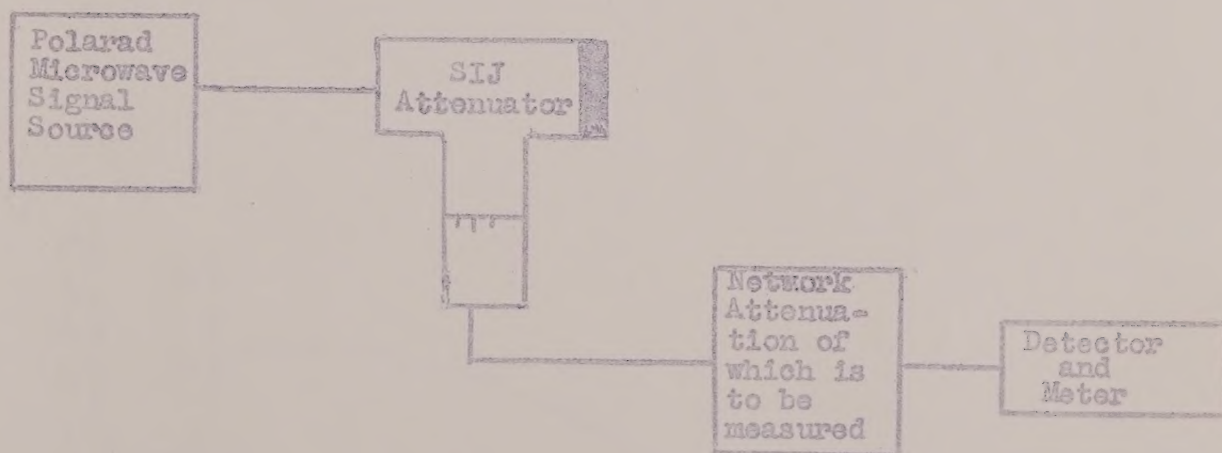


FIG. 2 - Attenuation Measurement with Model SIJ

The attenuator scale setting and meter reading are noted without the network to be tested in the circuit. Then the network is connected as shown above and the attenuator setting adjusted to give the same reading on the meter. The difference in the attenuator scale settings is noted and translated into db loss by means of the calibration curve.

3. Electrical Characteristics

The Model SIJ Attenuator is of the continuously adjustable mutual inductance (wave-guide beyond cut-off) type. Its electrical specifications are:

Frequency Range	4 kmc - 12.4 kmc
Impedance	50 ohms, nominal
Calibrated Range	Approximately 140 db, starting at 10 db
Insertion Loss	10 db minimum

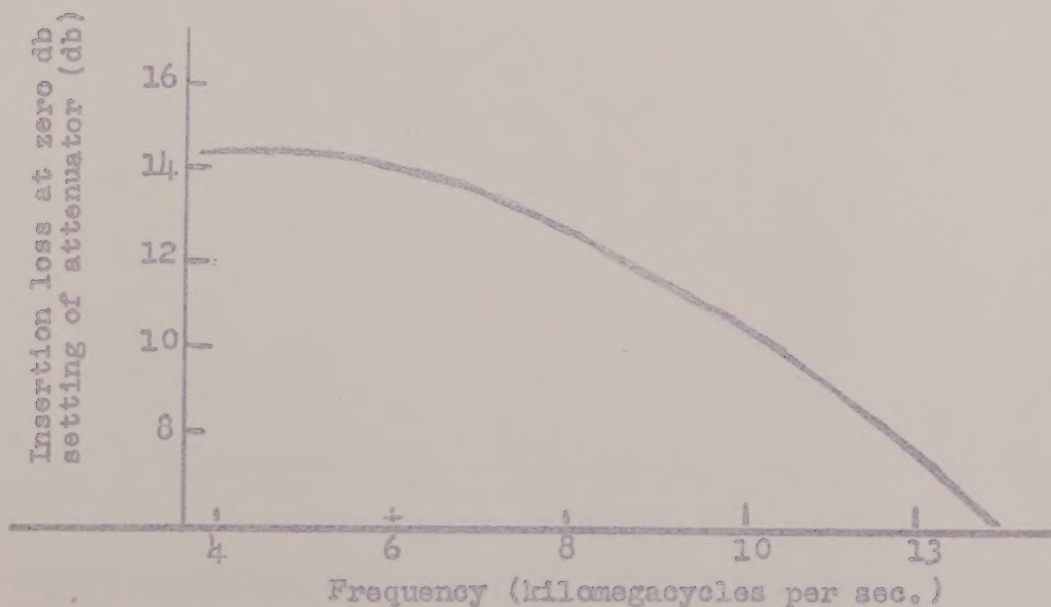


FIG. 3 - Insertion loss at zero setting of Model SIJ

4. Physical Description (See Fig. 4)

The wave-guide portion of the SEJ Attenuator is Tee-Shaped. One side of the cross-bar of the Tee is the input. The other side contains a tuning stub. The leg of the Tee is the attenuator barrel and output. A coaxial transmission line and UC-18B/U connector connect the Attenuator to the signal source. The transmission line excites the wave-guide and the output voltage is derived from a loop mounted on a sliding sleeve. The position of the loop with respect to the wave-guide and therefore the amount of attenuation is controlled by the rotation of an external barrel. This is a micrometer screw

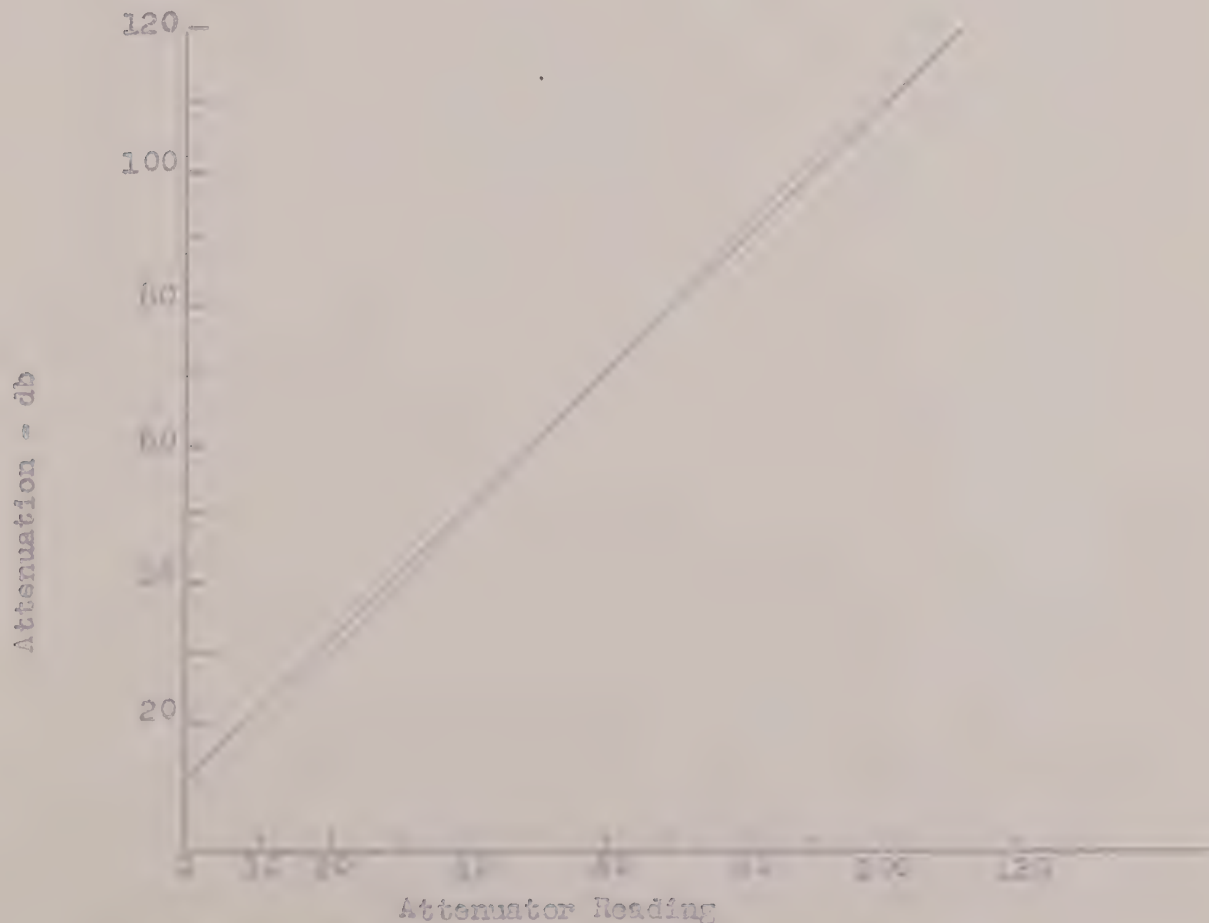


FIG. 4 - ATTENUATOR CALIBRATION CURVE AT 9130 MC

adjustment. The attenuator scale has two major divisions marked 50 and 100, and twenty-five sub-divisions, each corresponding to a change of 5 points on the scale. Each full rotation of the barrel should be made before the 100-division mark is reached. A calibration curve is provided (Fig. 4). The output of the attenuator is another

5. Factors Affecting Attenuation

In all wave-guide attenuators, the excitation of modes other than the desired one distorts the theoretical attenuation characteristic, particularly at low attenuation levels. In the most serious offender. This mode is attenuated more rapidly with distance from the source end of the wave-guide than is the desired mode and its intensity is proportional to the voltage across the exciting line, at the coupling point, while the intensity of the desired mode is proportional to the current flowing in the exciting line at the point of coupling. The effect of the undesired mode on the attenuation increases. Since the output from the attenuator is the sum of the voltages generated in the loop, by both modes, the error is largest if the voltage in the exciting line at the coupling point is high compared to the current, that is if the impedance is high.

The calibration chart, Figure 4, shows the effect of this error. It is assumed that the impedance of the exciting line is 50 ohms. The attenuation values apply only to this impedance. If other impedance values are used, the calibration curve should be corrected if sources of other impedance values are used.

The tuning stub provided enables the impedance to be tuned so as to maximize the output and the calibration curve then applies more closely.

At higher frequencies the attenuation is reduced due to the wave-guide approaching its cut-off frequency. To correct for this effect, multiply the calibration chart attenuation indicated in Figure 4, by the correction factor. For the operation frequency, Figure 5 indicates the correction factor to be applied, according to the formula:

$$\text{Actual Attenuation} = K \times \text{Indicated Attenuation}$$

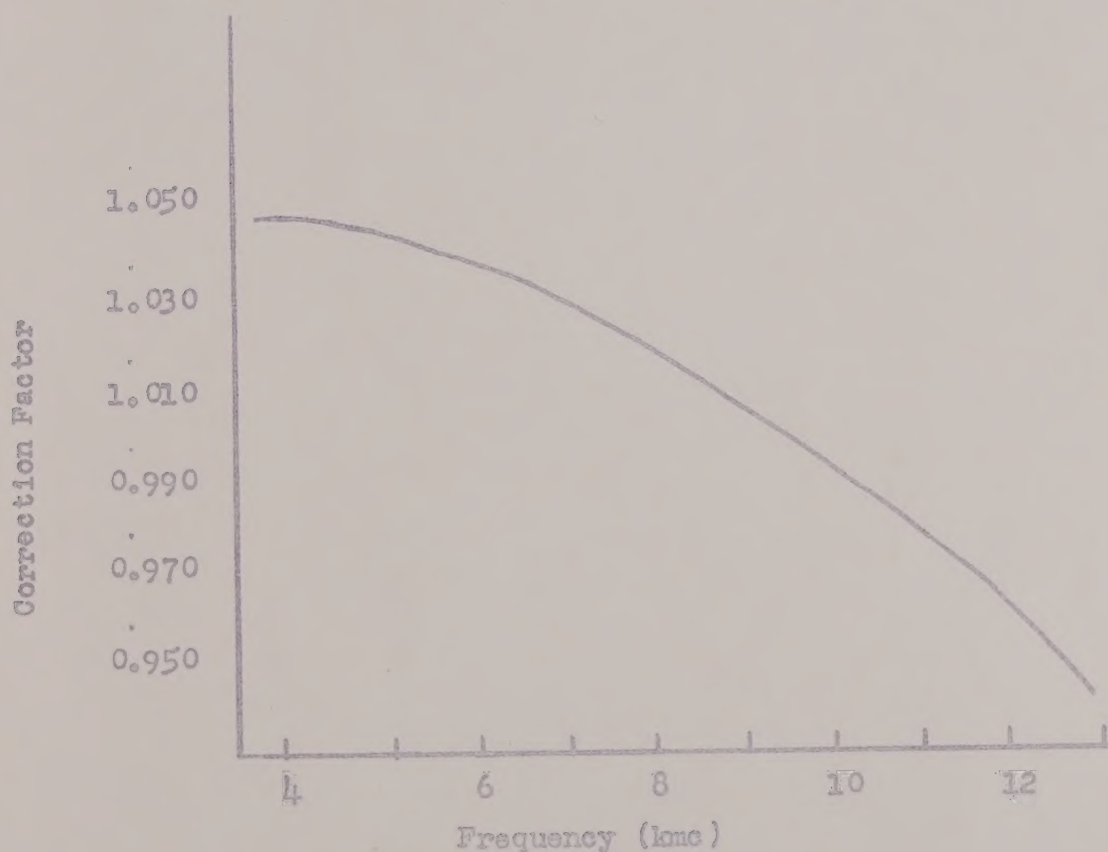


FIG. 5 - FREQUENCY CORRECTION FACTORS



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